Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

Aeronet Global Communications Inc.'s Petition for Rulemaking to Amend the Commission's Allocation and Service Rules for the 71-76 GHz, 81-86 GHz, and 92-95 GHz Bands to Authorize Aviation Scheduled Dynamic Datalinks	)	RM-11824
Aeronet Global Communications Inc.'s Petition for Rulemaking to Amend the Commission's Allocation and Service Rules for the 71-76 GHz, 81-86 GHz, and 92-95 GHz Bands to Authorize Maritime Scheduled Dynamic Datalinks	)	RM-11825

REPLY COMMENTS OF MOOG

Moog Inc. ("Moog"), by its attorney, hereby submits its reply to those initial comments filed on the Petitions for Rulemaking of Aeronet Global Communications Inc ("Aeronet") (collectively, the "Petitions").[1] Moog focuses its comments on Aeronet's desire to utilize the 94 GHz band (92.0-95.5 GHz) for Scheduled Dynamic Datalinks ("SDDLs") from land-based stations to passenger jets and other aircraft and maritime vessels, including cruise ships, ferries, and other ships. As stated herein, Moog shares the concerns of commenter Sierra Nevada

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[1] *See* Public Notice, Report No. 3112, *Aeronet Global Communications Inc.'s Petition for Rulemaking to Amend the Commission's Allocation and Service Rules for the 71-76 GHz, 81-86 GHz, and 92-95 GHz Bands to Authorize Aviation Scheduled Dynamic Datalinks,* RM-11824 (CGA rel. Feb. 7, 2019); Public Notice, Report No. 3113, *Aeronet Global Communications Inc.'s Petition for Rulemaking to Amend the Commission's Allocation and Service Rules for the 71-76 GHz, 81-86 GHz, and 92-95 GHz Bands to Authorize Maritime Scheduled Dynamic Datalinks,* RM-11825 (CGA rel. Feb. 7, 2019).

Corporation that Aeronet fails to provide technical information supporting its claimed ability to operate on a basis compatible with other users.

I. MOOG'S INTEREST IN THIS PROCEEDING

Moog Inc., headquartered in East Aurora, NY, is a worldwide designer, manufacturer, and integrator of precision control components and systems. Moog's high-performance systems control military and commercial aircraft, satellites and space vehicles, launch vehicles, missiles, automated industrial machinery, marine and medical equipment. Moog is a leader in motion control technology that enhances performance in a variety of markets and applications, from commercial aircraft cockpits, to power-generation turbines, to Formula One racing, to medical infusion systems. Moog has a variety of airport and airfield solutions including airport runway surveillance, distance measuring equipment, direction finding, and tactical air navigations.

At the heart of Moog's airport runway surveillance capabilities is a 2015 exclusive agreement its United Kingdom subsidiary, Moog Fernau Ltd ("Moog Fernau"), entered into with QinetiQ Ltd. to license QinetiQ's Tarsier Automatic Runway Foreign Object Debris ("FOD") Detection System ("Tarsier").[2] Tarsier, the world's first automatic runway FOD detection and warning system, uses millimeter wave radars centered at 94.32 GHz with a sweep of +/- 1.44 GHz to continuously scan runway surfaces.[3] These high-resolution radars are ideally

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[2] QinetiQ is a former United Kingdom government agency called Defense Evaluation and Research Agency ("DERA"). Tarsier was developed based on research QinetiQ conducted for the United Kingdom Ministry of Defense and was designed to military specifications.

[3] QinetiQ's choice of the 94 GHz band over the 76-77 GHz band followed from its intent to detect a target radar cross section of the order of 0.001 m^2 on runways of up to 4000 m. 94 GHz was deemed more advantageous for several reasons. In brief, attenuation at 77GHz is nearly twice as great as at 94 GHz, making the former less suitable for a long range, millimetre wave radar. The higher frequency at 94 GHz improved the ability to detect smaller objects that could pose a threat to aviation systems if undetected. For similar reasons, the radar cross section of volumetric radar rain clutter is significantly greater at 76-77 GHz, supporting more robust detection

suited for detecting debris day or night in clear or raining conditions and alerting airport operators of objects found, which can potentially be debilitating to jet engines and otherwise dangerous to aviation operations.[4] Tarsier's radar performance is not affected by dust or heat waves and pinpoints debris location in precise range and bearing. Unlike camera-only systems, Tarsier continues to provide timely and accurate debris detection in low light conditions especially in complete darkness and adverse weather including snow, sandstorms and dense fog.[5]

Tarsier was inaugurated at Vancouver, Canada's airport in 2006. Tarsier now has more than 100,000 hours of operation at airports in Vancouver, Heathrow, and Doha, and the Boscombe Down RAF airbase.

In 2018, Moog was awarded a research/development and evaluation contract led by the United States Navy, to deploy Tarsier for the United States Marine Corps. Work began in November of last year at the United States Marine Corps Air Station, in Yuma, Arizona. The contract also includes an option for an installation of the Tarsier system at the Corps's Air Station at Cherry Point, North Carolina.

Building on these earlier successes, and previous reviews of its Tarsier system by the Federal Aviation Administration ("FAA") as part of the FAA's development of FOD-related

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performance in rain at 94 GHz. Further, Moog concluded 76-77 GHz band was in danger of becoming congested by a variety uses, where 94 GHz was not likely to be as heavily used.

[4] FOD can range from wildlife to aircraft parts to stones to litter.

[5] Advanced digital signal processing accurately identifies and confirms debris eliminating false alarms. The system has been proven to detect metal, plastic, rubber, glass and organic matter. Status information is relayed to airport operators through a single intuitive graphical display. Live video feeds from a powerful MIL-SPEC day and night camera systems are automatically cued to allow object verification before personnel are dispatched to remove debris. A high resolution night camera combined with a near infrared illuminator tuned to the lens system far exceeds any competing night vision system. An event log records data for historical analysis.

standards,[6] Moog and its subsidiary, Moog Fernau, look forward to wider deployment of the Tarsier system at U.S. locations, both military and civilian. Moog is evaluating the filing of a petition for rulemaking with the Commission to enable the introduction of Tarsier FOD systems at non-Federal government airfields. As such, Moog has an interest in any proposals to introduce new systems in the 94 GHz radiolocation band which could possibly harmfully interfere with Tarsier system deployments and create potential dangers in locations where Tarsier may be deployed.[7]

II. DISCUSSION

While Aeronet states that its proposed SDDLs are "unlikely to present interference concerns,"[8] there is insufficient information in the Petitions to support that conclusion. As Sierra Nevada points out, what Aeronet proposes is much different than the fixed links that are permitted in the 92.5-95 GHz Band today: "[T]he transmission of high power signals to and between moving end points, at directions not in the horizontal plane, is a much different use of

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[6] Tarsier served as basis for stringent radar criteria for FAA FOD detection standards. *See, e.g., Edwin E. Herricks, Elizabeth Woodworth, Sid Majumdar, James Patterson Jr., DOT/FAA/AR-10/33, Performance Assessment of a Radar-based Foreign Object Detection System (Feb. 1, 2011) available at* http://www.tc.faa.gov/its/worldpac/techrpt/ar1033.pdf; U.S. Dep't of Transp., Fed. Aviation Admin., AC No. 150/5220-24, *Airport Foreign Object Debris (FOD) Detection Equipment* (Sept. 30, 2009), *available at* https://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.information/documentNumber/150_5220-24; U.S. Dep't of Transp., Fed. Aviation Admin., AC No. 150/5210-24, *Airport Foreign Object Debris (FOD) Management* (Sept. 30, 2010), *available at* https://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.current/documentNumber/150_5210-24.

[7] Moog takes no position in these reply comments regarding Aeronet's proposed use of the 71-76 and 81-86 GHz Bands. Any technical or operational information that Aeronet provides should encompass these bands as well as the 94 GHz band so as to allow other operators in the bands, as well as in adjacent bands, if appropriate, to assess the potential for harmful interference from Aeronet's proposed operations.

[8] *See, e.g.,* Aeronet Petition, RM-11824 at 18, Aeronet Petition, RM-11825 at 17.

spectrum from the fixed point-to-point microwave operations currently allowed under Part 101."[9] Aeronet fails to provide sufficient information regarding its proposed deployments to know what the prospects are for aircraft using SDDLs to potentially illuminate Federal or non-Federal airfields where other types of 94 GHz systems may be operating. Moreover, without knowing if there will be restraints on the location and orientation of land stations using SDDLs, whether maritime or aviation – Aeronet does not provide any apart from allowing that some restrictions might result from coordination with fixed-service links – there is potential for interference to other co-band operations at airfields that might fall within the changing pointing direction of SDDL land station transmitters. Aeronet notes that in the aviation scenario, the SDDLs could be oriented down to 5 degrees above the horizon and maritime SDDLs are typically going to be in or very close to the horizontal plane. In short, the land station transmission of SDDL signals could potentially sweep across airfields in their vicinity causing potential harmful interference to any co-band operations.

It would also be helpful for interested parties such as Moog to have other information to assess compatibility of SDDL operations in the 94 GHz Band, such as Aeronet's intended antenna characteristics and effective isotropic radiated power (e.i.r.p.), which the Petitions do not provide. Aeronet proposes to champion a variety of technical innovations in the high millimetre wave bands,[10] consistent with the multiple allocations in the Table of Frequency Allocations for the 94 GHz Band. But, without information like the foregoing, it is impossible to gain any comfort regarding the extent to which systems are compatible.

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9 SNC Comments, filed RM-11824 and 11825 (filed March 11, 2019) at 4.

10 *See, e.g.,* Aeronet Petition, RM-11824, at 26.

Moog submits that its FOD system will be compatible with many other 94 GHz operations, in part because of the limited locations where Tarsier will be deployed (*i.e.*, at airfields) and because of the use of down-tilted antennas, *i.e.*, oriented toward the surface of the runways. While the foregoing characteristics will tend to make Tarsier a good neighbor to most, if not all, they do not inherently protect Tarsier against interference from other systems. Consequently, Moog concurs with Sierra Nevada that "[t]he Commission should ensure that sufficient information is provided in the record to allow parties to analyse the potential interference effects of Aeronet's proposal."[11] It may be, once the Aeronet information is available for evaluation, that Moog may conclude that Aeronet's proposed solutions are fully compatible with Tarsier when supported by straightforward coordination or mitigation measures where needed.

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11 SNC Comments at 6.

III. CONCLUSION

For the reasons stated above, Moog submits that the Commission should not act on the Petitions with respect to the 94 GHz band until Aeronet provides sufficient information to allow compatibility assessments with other uses of 94 GHz. Interested stakeholders should have the opportunity to conduct analyses and give the Commission the benefit of the same in further submissions.

Respectfully submitted,

MOOG, INC.

Edward A. Yorkgitis, Jr.
KELLEY DRYE & WARREN, LLP
3050 K Street, NW
Suite 400
Washington, DC 20007
(202) 342-8420

Its Counsel

Paul Revell
Managing Director
MOOG FERNAU LTD.
Airport Executive Park
Luton
Beds LU2 9NY
United Kingdom

26 March 2019

CERTIFICATE OF SERVICE

I, Edward A. Yorkgitis, Jr., hereby certify that on March 26, 2019, a copy of the foregoing Reply Comments of Moog on the Aeronet Petitions was served by U.S. Mail on the following:

Samuel L. Feder
Roger C. Sherman
Elliot S. Tarloff
Jenner & Block, LLP
1099 New York Avenue, NW
Suite 900
Washington, DC 20001
Counsel for Aeronet Global Communications, Inc.

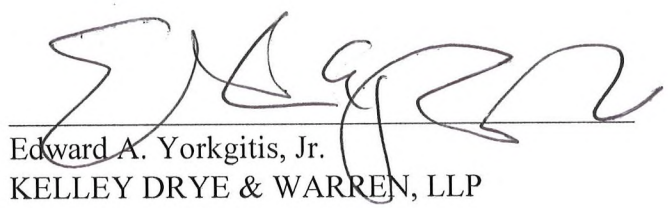
Laura Stefani
Mintz, Levin, Cohn, Ferris, Glovsky and Popco, PC
701 Pennsylvania Avenue, NW
Suite 900
Washington, DC 20004
Counsel for Sierra Nevada Corporation

Julie M. Kearney
Head of Regulatory Affairs
Loon LLC
1600 Amphitheatre Parkway
Mountain View, CA 94043

Steve B. Sharkey
John Hunter
Christopher Wieczorck
T. Mobile USA, Inc.
601 Pennsylvania Avenue, N.W.
Suite 800
Washington, DC 20004

Brian Weimer
Douglas Svor
Samuel Swoyer
Sheppard Mullin Richter & Hampton LLP
2099 Pennsylvania Avenue NW, Suite 100
Washington, DC 20006
Counsel to WorldVu Satellites Limited

Chris DeMarche
Elefante Group
4725 S. Monaco Street, Suite 330
Denver, CO 80237



Edward A. Yorkgitis, Jr.
KELLEY DRYE & WARREN, LLP
050 K Street, NW
Washington, DC 20007
(20) 342 8540